

The University of Chicago

AN EXPERIMENTAL TEST OF
FREUD'S DOCTRINE OF THE RELATION OF HEDONIC TONE TO
MEMORY REVIVAL

A DISSERTATION SUBMITTED TO THE
FACULTY OF THE DIVISION OF THE
BIOLOGICAL SCIENCES IN CANDIDACY
FOR THE DEGREE OF DOCTOR OF
PHILOSOPHY

DEPARTMENT OF PSYCHOLOGY

1938

By

AGNES ARMINDA SHARP

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PROBLEM

This study ¹ was designed as an experimental test of the truth of Freud's doctrine of the relation of hedonic tone to memory revival. As a basis for a critical evaluation of any experimental test of the doctrine, an explicit statement of the various assumptions underlying the theory is a first essential. Freud was primarily a clinician and not a systematist, and hence we find no explicit statement of several features of his theory in his writings. A knowledge of these must be derived from the context, and their nature is to some extent a matter of personal interpretation. We shall first state our opinion of the various implied tenets of the doctrine.

1. Freud assumes (1) that unpleasant experiences are less likely to be revived than are pleasant and neutral experiences, and (2) that pleasant experiences are more likely to be revived than are unpleasant and neutral experiences.

There is no dispute about this feature of Freud's doctrine. The process of excluding unpleasant and painful experiences

¹ From the Psychological Laboratory of The University of Chicago. The writer wishes to acknowledge her indebtedness to Dr. Harvey A. Carr, Chairman of the Department of Psychology at The University of Chicago, under whose direction this study was made.

from memory is labelled a repression mechanism, and this mechanism is one of the basic concepts of his psychoanalytic theory. Freud also refers to the memory enhancement of pleasant experiences, and phantasy and daydreaming are cited as examples. His implied use of this process of memory enhancement which along with repression plays a decisive role in Freud's conception of the causation and treatment of the psychoneuroses and psychoses is the generally accepted one of striving toward gaining pleasure. He refers to it less frequently, and he has not given it a specific label as in the case of repression.

2. Freud implicitly assumes that hedonic tone is merely one of the factors influencing the likelihood of recall. The relative likelihood of recall of a series of items may also be a function of a number of other variable factors. Pleasant items will be more frequently recalled, and unpleasant items less frequently recalled, than are neutral items only when all other factors influencing recall are equal. No experimental setup can be regarded as a decisive test of the truth of Freud's doctrine unless these residual factors are adequately controlled.

3. In our opinion, Freud tacitly assumed that the differential effect of hedonic tone upon memory revival will be manifested only after some interval of time, and that this effect tends to increase with time. Freud did not assume that the memory revival of an unpleasant experience is immediately inhibited once and for all. Repression is actually an after-expulsion. Time is required for the mechanism of repression to be effective. In this connection we may note that many of the experiments that have been performed to test the truth of Freud's doctrine measured the relative revivability of pleasant and unpleasant items after an interval of only a day, and in these cases negative results were generally obtained. Such experiments cannot be regarded as an adequate test of Freud's theory. Any decisive experiment must employ tests for delayed recall.

We cite several considerations in support of our interpretation of this feature of Freud's theory. (1) Freud's doctrine was derived from his clinical experience of the repression in

adult life of unpleasant childhood experiences. He was here dealing with the inability to recall after very long intervals of time. (2) Repression, according to Freud, is primarily a defense mechanism. It is a means of getting rid of perseverating memories of an unacceptable and emotionally disturbing nature. If the unpleasant experiences did not at first exhibit a considerable amount of perseverative revival, there would be no need for repression. One might say that an unpleasant experience is one that naturally exhibits a considerable amount of initial memory revival, and one whose revival is mentally disturbing. Repression is thus a device to get rid of these disturbing memories. The theory thus assumes, in our opinion, that unpleasant experiences exhibit a considerable degree of initial revival, and that their repression is attained only after some interval of time. (3) Repression is a continuous process. An unpleasant memory is not permanently banished by a single mental fiat. The tendency to revival is always present, and this tendency must be continually inhibited. This feature of Freud's doctrine is quite evident in the following quotation:

"The process of repression is not to be regarded as something that takes place once and for all, the results of which are permanent, as when some living thing has been killed and from that time onward is dead; on the contrary, repression demands a constant expenditure of energy, and if this is discontinued the success of the repression will be jeopardized, so that a fresh act of repression would be necessary. We may imagine that what is repressed exercises a continuous straining in the direction of consciousness so that the balance has to be kept by means of a steady counter-pressure."²

4. Repression of the unpleasant and the enhancement of the pleasant are regarded as universal mechanisms, *i.e.*, exhibited by all individuals normal, psychoneurotic, and psychotic. The doctrine was derived from Freud's clinical study of psychoneurotic and psychotic subjects, but it was later extended to normal subjects as is illustrated by his book,

² Freud, S., *Collected Papers*, London: Hogarth Press, 1925, Vol. IV, pp. 89-90.

The Psychopathology of Everyday Life.³ Freud makes no statements as to the relative degree to which these mechanisms are exhibited by the two classes of subjects. His followers state that psychoneurotic and psychotic subjects exhibit a greater amount of unsuccessful repression than do normal subjects. Freud has said "unsuccessful repression will have more claim on our interest than that of repression which is eventually successful; the latter will for the most part elude our study."⁴

This raises the question as to the type of subject that should be employed in order to make a decisive test of the truth of Freud's doctrine. It would seem that the use of psychoneurotic and mildly psychotic subjects would be the more appropriate, and perhaps the use of both normal and abnormal types of subject is advisable.

5. Obviously any test of the doctrine must use memory materials that conform to Freud's conception of the nature of pleasantness and unpleasantness. Freud has not explicitly defined these terms, and hence their meaning must be derived from a study of the context in which they are used. In our opinion, Freud's usage differs considerably from that of the conventional academic type of psychology which regards a pleasant or unpleasant experience as one which contains a specific *affective element*. Freud uses the terms more in their popular sense, and an experience is labelled as pleasant or unpleasant primarily on the basis of its dynamic and emotional characteristics. Repressed experiences are usually termed complexes, and it is generally admitted that this term has certain dynamic and emotional implications. We shall state briefly our conception of this feature of Freud's doctrine.

An unpleasant experience is one which we shall hereafter refer to as an *unacceptable* one. It is an experience that is so out of harmony with the individual's ideals, values and established modes of conduct that it is mentally and emotionally disturbing, and hence stimulates him to attempt to get rid of it. After one has had such an experience, there is but one

³ Freud, S., *The Psychopathology of Everyday Life*, New York, The Macmillan Company, 1914, p. 338.

⁴ Freud, S., *Collected Papers*, London: Hogarth Press, 1925, Vol. IV, p. 92.

way to get rid of its memory revival, viz., to banish it from mind and attempt to prevent its future recurrence. Repression is a defense mechanism—a device used to get rid of emotionally disturbing memories. In other words, one might very well define an unpleasant memory as one which we tend to repress or forget.

A pleasant experience, on the other hand, is an *acceptable* one. It is an emotional experience that is so in harmony with our sense of values and established beliefs and modes of conduct that it stimulates us to prolong and repeat it. It is an experience which tends to elicit a positive adaptive reaction. A pleasant memorial experience is thus one which we attempt to dwell upon and prolong, and which we desire to repeat. A pleasant memory, by definition, is one toward which we tend to react in such a manner as to enhance the likelihood of its future revival.

HISTORICAL

A considerable number of experiments have been performed to test the truth of Freud's doctrine. The results of some of these experiments are cited in support of Freud's doctrine, while many others find no differential effect in the recall of pleasant and unpleasant materials. As crucial tests of Freud's theory, most of these experiments are defective in that they do not conform to one or more of the above mentioned requirements.

1. All of these studies have employed normal subjects. While the use of such subjects probably cannot be regarded as a fatal defect, yet in our opinion psychoneurotic and mildly psychotic subjects would be more appropriate; and probably the use of both normal and abnormal subjects is advisable.

2. A large number of these experiments have tested recall only after an interval of a day, and they have generally failed to find any differential effect for pleasant and unpleasant materials. As we have indicated, such experiments cannot be regarded as crucial tests of the truth of the theory.

3. A few experiments have failed to equate the other factors influencing the relative likelihood of recall for the two

types of material. In this type of experiment, the subject is asked to recall as many pleasant items from his previous experiences as is possible in a given interval of time. The test is then repeated for unpleasant items. More pleasant items are usually recalled in this type of test, and this fact has been advanced in support of Freud's theory. The data are not decisive, however, for the differential results may be due to other factors than the hedonic character of the experiences. The relative amounts recalled may be due in whole or in part to such factors as the unequal number of the original experiences, their character, their degree of fixation, and the intervals elapsing between the recall and the original experience.

4. The major defect of most of these experiments is the fact that they did not use memory materials that conform to Freud's conception of the nature of pleasantness and unpleasantness. In one experiment, for example, the pleasant list of words to be memorized contained such items as smooth, fragrant, sweet, airy, clean, soft, kiss, reward; while the unpleasant list was composed of such items as dirty, chilly, rough, guilt, funeral, scorn, bitter.

Of the studies purporting to test Freud's hypothesis, two seem pertinent to this experiment. Koch⁵ gave ten ten-minute quizzes over a period of twenty-three days to three equivalent classes in educational psychology. Each quiz was graded and returned to the writer at the next meeting of the class. The subjects were instructed to mark in class on a scale of 1-5 to indicate their reactions to the grade received in terms of the dimension 'very happy—happy—discouraged.' The papers were again collected by the instructor. After the tenth quiz no further examinations were held. Five weeks later the subjects unexpectedly were asked to recall all 10 grades. The 152 subjects were divided into two groups: those who had and those who had not kept a written record of their grades. Both groups recalled the '1' grades best. That is to say that the pleasant, in general, were correctly recalled

⁵ Koch, H. L., The influence of some affective factors upon recall, *J. General Psychology*, 1930, 4, 171-190.

relatively more frequently than unpleasant ones. The group that kept records recalled the '5' grades second best, while the ones who had no written record recalled the '2' grade second best. That is, grades reported as pleasant or unpleasant tended to be better remembered than those reported as stimulating no affective reaction. Indifferent grades were remembered most poorly. Koch states that there seemed to be a slight relationship between the possession of such traits as are listed in the Woodworth Wells Personal Data Sheet and the tendency to remember relatively poorly unpleasant grades.

Does Koch's study satisfy the Freudian criterion of pleasantness and unpleasantness? Are these really poignant experiences to the average undergraduate? Did the student report his real attitude toward his grades or did he report what ought to be his attitude according to academic standards? If the student received a 'C' when he expected 'C' he would not be discouraged. If he received an 'A' when he expected a 'C' he might be indifferent or elated according to his sense of values. His attitude to a grade received will be a function of its relation to what was expected and desired.

Stagner⁶ was interested in finding the relation of the feeling tone aroused by an experience to the retention of that experience. He felt that it is possible that the factors influencing emotional reaction are likewise those which determine retention, rather than that the feeling tone itself is a factor influencing memory. To investigate this phenomenon he felt that the narration of personal experiences by the subject was the best suited experimental setup.

One hundred and one subjects were given mimeographed sheets on which blank lines were provided for a brief description of the most pleasant and the most unpleasant experience of the preceding 15 days. Below this were provided 10 lines for as many items of detail and fact (such as odors, sounds, images, etc.) associated with the experiences as the subjects could note down. Three weeks later a typewritten copy of his description was handed to each subject on the same kind of

⁶ Stagner, R., The redintegration of pleasant and unpleasant experiences, *Amer. J. Psychol.*, 1931, 43, 1020-8.

sheet; the list of associated items had been left off. The subjects were instructed to fill in as many as they could recall. Accuracy and completeness were taken as a measure of the redintegration of the experience. Scoring was done on the basis of the ideas rather than the words. Associations not given previously were thrown out. A greater percentage of the items associated with pleasant experiences than with unpleasant was recalled, the difference being 3.37 times the sigma of the difference. There is a reliable difference between the completeness of redintegration of pleasantness and unpleasantness after three weeks. An active process of forgetting is suggested by the fact that there is a reliable difference (2.99) between the relative recencies of the pleasant and unpleasant events given, and a considerable difference in the relative fluency of associations of details for the two events. In recalling unpleasant experiences the tendency to inhibit the revival of associated experiences may be regarded as repression.

Stagner's setup is in harmony with Freud's two criteria: (1) that unpleasant experiences tend to be repressed while pleasant experiences are enhanced in recall, and (2) that time is necessary for successful repression. He deals not with the revival of the experience, but rather with which of these two experiences when revived in memory will arouse the most associations. His assumption is, of course, that the more associations the more completely is the experience recalled in memory. While these are real experiences we do not know whether they are pleasant and unpleasant in Freud's sense.

PROCEDURE

In our experiment, the memory materials consisted of three lists of 15 paired associates each. One list was composed of acceptable items, one of unacceptable items, while those of the third list were neutral or indifferent in hedonic tone. These materials are given in Table I. Three groups of psychoneurotic subjects, each consisting of 23 individuals, were employed. Each group memorized one of these lists to the point of one successful repetition, and later was subjected to three successive oral recall tests on 2, 9, and 16 days after original learning. After the last recall test, the subjects relearned the list to the criterion of one perfect reproduction. The experiment was then repeated upon three groups of normal subjects, each consisting of 22 individuals. For each of the six groups we obtained the following records—

learning scores, relearning scores, and the number and character of the items correctly recalled for each test.

The learning method was adopted in order to equate for the three conditions such factors as length of list, degree of learning, and length of time intervening between learning and recall. Psychoneurotic subjects were employed in order to make a crucial test of the theory, and the experiment was repeated upon normal subjects in order to discover whether the phenomena of repression and enhancement are alike or different in respect to character or amount for the two types of subject. Successive recall tests distributed over some interval of time were employed in the hope of discovering the approximate time of the onset of repression and enhancement, and possibly of testing the assumption that the amount of repression or enhancement increases with time. In the absence of knowledge, our selection of intervals was purely arbitrary, and it is frankly recognized that a greater number of tests distributed over a much longer interval of time would have been advisable. However our choice of the maximum interval was determined by the practical difficulty of keeping experimental control of such a large number of subjects for any longer period of time.

A distinctive feature of our experiment is the choice of memory materials. Since psychoneurotic subjects were to be used for a decisive test of the theory, we wished to use memory materials that were definitely known to be acceptable, unacceptable or neutral to these subjects. We had case histories and clinical notes taken in connection with the examination and treatment of 130 psychoneurotic and mildly psychotic patients in the Psychiatric Clinic of Rush Medical College. These records were analyzed with a view to finding a list of items that were unacceptable to all of these patients. On the basis of this analysis, we selected the 15 unacceptable items given in Table I. We chose these items on the basis of the repeated statements in the records that each of these patients had found these items to be distinctly disturbing and troublesome. The lists of acceptable and neutral items were selected in a similar manner. Of the 130 patients, we were able to make contact with and to induce 69 to serve as subjects in the experiment. The items selected were thus known to be acceptable, unacceptable, or neutral to all of the psychoneurotic subjects.

TABLE I
SHOWING THREE TYPES OF MATERIALS

(1) Acceptable Material	(2) Unacceptable Material	(3) Neutral Material
1. developing memory	1. failing always	1. carrying baskets
2. gaining affection	2. seeking attention	2. leaning down
3. securing justice	3. feeling inferior	3. arranging flowers
4. enjoying life	4. fearing poison	4. coming inside
5. growing attractive	5. losing out	5. blending colors
6. succeeding often	6. blaming me	6. scrambling over
7. liking folks	7. knowing jealousy	7. humming songs
8. thinking clearly	8. hating everybody	8. drawing pictures
9. acting generously	9. disliking folks	9. flying kites
10. becoming important	10. crying frequently	10. opening cans
11. feeling better	11. forgetting everything	11. going places
12. winning respect	12. going insane	12. making things
13. living safely	13. desiring babies	13. twirling around
14. finding contentment	14. wanting marriage	14. getting out
15. laughing happily	15. avoiding passion	15. pointing upward

In this type of experiment, it is evident that the subject is engaged in the task of memorizing and recalling words that symbolize certain acceptable or unacceptable experiences. Since these words as words have no hedonic tone, it is entirely possible for a subject to memorize and recall such a list as abstracted from their personal hedonic significance. Especially may this occur in those experiments which use a series of nouns as memory material, and it is quite obvious that such abstraction will necessarily vitiate an experiment as a decisive test of Freud's theory. Consequently we wished to use as memory material a series of verbal symbols that are likely to be memorized and recalled on the basis of their personal hedonic significance. After canvassing various possibilities, we adopted the method of denoting these acceptable and unacceptable items of experience by a unitary phrase of paired associates, each consisting of a verb as the stimulus term and a noun or qualifying word as the response term. This mode of arrangement has several advantages. 1. A unitary phrase is much more concrete and particular in its significance than is a single word. 2. Only familiar words were employed, and familiarity is conducive to the use of meaning. 3. Verbs were chosen as the stimulus terms, because these verbs imply a subject and thus emphasize the personal significance of these items. 4. The use of the paired associates also enabled us to equate the three lists in respect to the length, number of syllables, degree of familiarity, and apparent difficulty of the response terms.

The normal subjects were taken from the writer's psychology class of adult employed persons. These subjects used the same lists as did the psychoneurotic subjects. Since these individuals were used primarily as a control test, no attempt was made to discover whether the lists of items were also acceptable or unacceptable to them. Inasmuch as the hedonic significance of these items exhibited a high degree of universality for the psychoneurotic type of subject, perhaps one is justified in assuming that the items possess much the same significance for the normal subjects.

For the purpose of this experiment it is essential that the three groups of each type of subject be approximately equal in respect to memorizing ability. We relied upon the method of chance selection to attain this result. The subjects were assigned to each of the three groups on the basis of the order in which they were tested. The first group thus consisted of the 1st, 4th, 10th, etc., subjects tested.

As a check on the composition of the groups, we secured at the time of testing the following records for each subject: chronological age (Otis Higher Form), I. Q. score, and a score on the Thurstone Personality Schedule. Table II gives the average values and standard deviations for each of the six groups and for the two types of subject. We also secured the medical diagnosis of each of the psychoneurotic or mildly psychotic individuals, and the composition of the three groups in respect to these diagnoses is given in Table III.

We may first note the differences between the *two classes* of subject. (1) The normal group has much the smaller personality score. This statement is true when we compare the averages for the two groups, and the score for each of the normal groups with the score for the corresponding abnormal group. This difference was to be expected, and it supports the diagnostic validity of this test. (2) The normal subjects have the larger I. Q. score in all four comparisons, and some of these differences exceed the limits of chance. (3) The normal subjects are the younger in three of the four comparisons. The exception refers to the two groups that learned the neutral materials. It may be noted that the difference between the group averages for each of the three categories exceeds the limits of chance. For the purposes of our experiment, however, it is not essential that the two groups be equal in respect to age, I. Q., personality score, or even learning ability. In fact, the close approximation of the

TABLE II
A COMPARISON OF THE NORMAL WITH THE ABNORMAL SUBJECTS

<i>Subjects Normal</i>							
Material	N	Age	S.D.	I. Q.	S.D.	Personality	S.D.
1. Acceptable.....	22	26.6	5.97	104.	5.8	27.89	10.3
2. Neutral.....	22	29.54	9.1	110.	10.35	20.68	9.95
3. Unacceptable.....	22	24.72	5.1	108.5	9.15	16.94	7.6
Total.....	66						
Averages.....		26.95	7.18	107.5	5.94	21.83	10.14

<i>Subjects Abnormal</i>							
Material	N	Age	S.D.	I. Q.	S.D.	Personality	S.D.
1. Acceptable.....	23	31.6	7.2	102.	9.0	89.6	16.08
2. Neutral.....	23	27.5	7.1	101.6	9.75	88.68	18.7
3. Unacceptable.....	23	31.69	5.56	104.7	7.65	75.9	11.0
Total.....	69						
Averages.....		30.26	6.94	102.4	8.8	84.72	15.48

TABLE III
SHOWING THE MEDICAL DIAGNOSIS OF THE ABNORMAL (EXPERIMENTAL) GROUPS

Diagnosis	Neutral Material: Number	Acceptable Material: Number	Unacceptable Material: Number
Alcoholic depression.....	1	1	1
Alcoholism and anxiety.....		1	1
Anxiety psychoneurosis.....	1	1	1
Compulsion neurosis.....	1	1	
Drug addiction.....	1	1	1
Fear of body odor.....			1
Functional colitis.....	1	1	1
Functional heart.....	1		1
Functional thyroid.....	1		1
Hysterical amnesia.....	1	1	
Hysterical fugue.....	1	1	1
Inferiority feelings.....	1	1	1
Manic-depressive.....	1	1	1
Dementia præcox (beginning).....	1	1	1
Paranoid.....	3	2	3
Pathological lying.....	1	1	
Psychopathic personality.....		2	2
Persecution ideas.....		1	1
Psychopathia sexualis.....	1	1	
Schizoid personality.....		1	1
Schizophrenia (mild).....	1	1	1
Situational depression.....	1	1	1
Stuttering.....	2		1
Suicide attempts.....	1	1	1
Functional torticollis.....	1	1	
Transportation phobia.....			1

two groups in respect to age, I. Q., and learning scores (Table IV) is quite surprising in view of the fact that they were drawn from different populations and that no attempt was made to equate them.

The attempt was made to equate the three groups of each class of subject by the method of chance selection, and hence we should expect that none of these differences will exceed the limits of chance. The data justify this expectation. All of the differences between the three psychoneurotic groups fall within the limits of chance variation, and the same statement is true for the three normal groups with the single exception of one of the differences in personality score. The data thus indicate that the three groups are also equated in respect to *memorizing ability* within the limits of chance variation.

One might have selected the three groups of each class of subject so as to attain an exact equation in respect to average age and I. Q. This method was not adopted for two reasons. (1) Age and I. Q. are independent variables, and it would have been practically impossible to equate the three groups in respect to both categories. (2) The essential requirement of the experiment is an approximate equation of the three groups in respect to *memorizing ability*. Hence an equation in respect to either age or I. Q. would attain this result only on the assumption of an approximately perfect correlation between one of these factors and memorizing ability. There is no evidence that these correlations are large enough so that an exact equation in respect to either age or I. Q. would give a better equation in respect to memorizing ability than the method of chance selection which we adopted.

All subjects were tested individually. We followed the usual procedure of the paired associates method. The 15 pairs of the list were serially presented, and each presentation was followed by a recall test. These alternate presentations and recalls were continued until the subject mastered the list up to the point of one perfect recall. For presentation, each pair of words was typed upon a separate white card. These cards were assembled in a pack, and the cards were manipulated by hand in a brass exposure box. The order in which the pairs were presented was kept constant from trial to trial. The duration of exposure of each pair was approximately 2 seconds, and the subject was required to pronounce both words during the period of exposure.

For the recall tests, we used a similar stack of cards each containing one of the stimulus terms. The order of presentation was varied from test to test by reshuffling the cards. The duration of exposure was 2 seconds, and the subject was requested to pronounce both the stimulus and the absent response term.

RESULTS

The numerical results obtained are given in Table IV. This gives the mean score and its P.E. for each of the six groups for the number of trials to learn, the number of words recalled on each of the three successive recall tests, and the number of trials required to relearn the lists. The mean scores and their P.E.s are listed for each of the two classes of subjects.

Learning Scores.—The mean learning score of the normal subjects is slightly smaller than that of the psychoneurotic

subjects. Likewise the score for each of the three normal groups is smaller than that for the corresponding abnormal group. These differences cannot be functions of the character of the lists, for the lists were the same in all four comparisons. The normal subjects are thus slightly superior in respect to memorizing ability. While an exact equation of the two types of subject is not essential to the purpose of the experiment, we may note that they are much more alike in respect to memorizing ability than one would expect in view of the fact that they were drawn from different populations and no attempt was made to equate them.

TABLE IV
MEAN SCORES AND P.E. FOR LEARNING AND RECALL FOR SIX GROUPS
OF SUBJECTS AND FOR TWO CLASSES OF SUBJECTS

Subjects	N	Material	Number of Trials to Learn	Number of Syllables 1st Recall	Number of Syllables 2nd Recall	Number of Syllables 3rd Recall	Number of Trials to Relearn
Normal.....	22	Acceptable	9.68 ± .630	8.68 ± .367	10.54 ± .530	10.18 ± .513	3.0 ± .294
Normal.....	22	Neutral	4.22 ± .190	10.04 ± .308	9.68 ± .378	9.13 ± .408	4.36 ± .342
Normal.....	22	Unacceptable	8.77 ± .422	6.45 ± .399	5.95 ± .396	5.72 ± .330	6.90 ± .406
Abnormal....	23	Acceptable	9.86 ± .819	9.17 ± .338	9.60 ± .403	9.17 ± .381	3.56 ± .256
Abnormal....	23	Neutral	6.52 ± .650	9.56 ± .276	8.56 ± .256	7.69 ± .361	4.39 ± .246
Abnormal....	23	Unacceptable	9.43 ± .596	5.86 ± .274	6.04 ± .492	5.86 ± .421	7.0 ± .559
Normal.....	66	3 Materials	7.57 ± .351	8.71 ± .239	8.7 ± .290	8.41 ± .082	4.75 ± .059
Abnormal....	69	3 Materials	8.60 ± .418	8.20 ± .220	7.9 ± .259	7.53 ± .067	4.95 ± .046

The three groups of each type of subject differ materially in respect to learning scores. In these comparisons, the differences may be functions of the groups or of the lists, and there is good evidence that both factors are operative. (1) The method of chance selection does not give an exact equation of the three groups; it equates them only within a certain range of chance error. The obtained differences in learning score must thus be accounted for in part in terms of group differences. (2) The character of the lists has also influenced the learning scores. This fact is attested by several lines of evidence. Some of the differences materially exceed the limits of chance variation. The differences between the scores for the neutral and the hedonic lists far exceed those obtained by comparing the two classes of subject for the same lists, and in the latter comparison no attempt was made to equate the two groups. The learning scores are not correlated with the

age and I. Q. records. Of the three normal groups, the one that learned the neutral lists was the oldest, had the highest I. Q., and made the lowest learning score. However, the abnormal group that learned the neutral list also made the lowest learning score, but its age and I. Q. scores were the smallest of the three groups. Finally the order of difficulty of the lists was exactly the same for the two classes of subject. In both cases, the neutral material was much the easiest to learn, and the acceptable material was slightly harder to learn than the unacceptable list. That is to say, the learning scores are correlated with the hedonic character of the lists and not with the group.

We may also note that the chance factor may operate to increase or decrease the size of the differences due to the hedonic character of the lists. Consequently in some of these comparisons, the list factor may be more efficacious than the obtained learning scores would indicate.

Recall Scores.—The recall scores were changed into percentage scores, and these values are graphically represented in Figs. 1 and 2. The continuous line gives the data for the unacceptable material, the dotted line for the neutral material, and the dash lines for the acceptable material. The initial value of 100 percent denotes the successful recall attained in the last learning trial.

These curves are like the conventional retention curve in that they exhibit an extremely rapid rate of initial forgetting. They exhibit a slower rate of forgetting for the two longer intervals than does the conventional curve. Any such difference is probably a function of the three successive recalls. Previous experiments have indicated that partial recalls tend to inhibit the subsequent rate of forgetting, and hence the values for the last two recalls were probably increased by the preceding recalls. However, the form of these curves as related to a conventional norm is not significant for our purposes, for we are interested merely in the differences between these six curves, and all were equally subject to the influence of this factor of successive recalls.

There are two outstanding characteristics of these recall scores. (1) The results are essentially identical for the normal and the psychoneurotic subjects, and (2) the amount recalled varies markedly with the list.

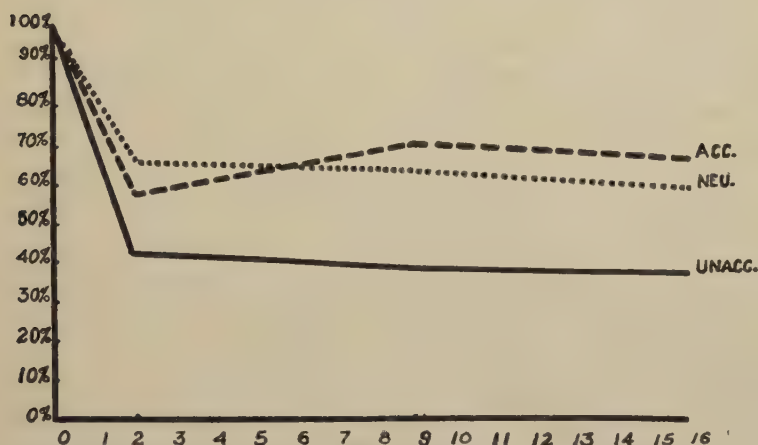


FIG. 1. Normal subjects. Percentages of recall for the three types of material.

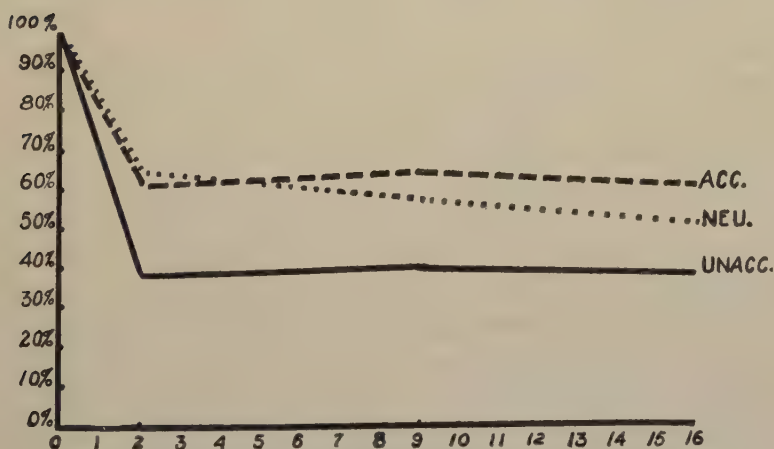


FIG. 2. Psychoneurotic subjects. Percentages of recall for the three types of material.

Both the normal and the psychoneurotic groups exhibit a large amount of repression of the unacceptable material relative to the neutral material. This repression is present at the two-day interval. Presumably the repressive mechanism

must begin to operate shortly after learning. There is some indication that the relative amount of repression may decrease for the psychoneurotic group after the two-day interval, but more tests distributed over longer intervals of time are essential to any final statement as to the existence of such a trend.

Both the normal and the psychoneurotic groups exhibit a small amount of repression of the acceptable material at the end of two days. The retention curves then rise, and both groups exhibit the phenomenon of enhancement for the 9- and 16-day intervals. The acceptable material is repressed at first and then enhanced in both groups. There is some indication that the relative amount of enhancement may increase for the psychoneurotic group with the passage of time, but any confident statement of the existence of such a trend will require a larger number of recall tests distributed over a much longer interval of time.

Theoretically the differences between the three retention curves for each type of subject may be functions of the groups or of the lists. Two facts indicate that they are primarily functions of the hedonic character of the lists. (1) The differences far exceed what may be reasonably expected on the basis of chance selection. (2) The same order of difference obtains for both the psychoneurotic and the normal subjects. In other words the differences are correlated with the nature of the lists and not with the groups.

We had also found that the differences between the learning scores are primarily functions of the character of the lists. The hedonic character of the lists is thus the prime determinant of both the learning and the recall scores, but it affects these two scores differently.⁷ The unacceptable material is much more difficult to learn than the neutral list, but it is more poorly retained. The acceptable material is also more difficult than the neutral list, but it is more effectively retained for the longer intervals. The acceptable and unacceptable materials are approximately equal in difficulty, but they differ radically in respect to retention.

⁷ As stated in the early description of this study there is a possibility of some other difference, other than hedonic tone, that was not equated and eliminated.

The differential effect of the hedonic character of the list upon the learning and recall scores is not inconsistent with what we know about the functional relation obtaining between these scores. It has long been known that these scores are related, but this relation is quite complex and it has as yet been inadequately analyzed. We shall mention briefly three principles involved in this relationship for which there is some experimental evidence. (1) When a given material is learned to the same criterion of mastery by individuals differing in ability, there is some evidence that the more proficient learners have the larger recall scores. Under these conditions, the learning and the recall scores tend to exhibit a negative correlation. (2) When individuals who are alike in ability learn the same materials by two different methods, *e.g.*, whole vs. part methods, massed vs. distributed practice, there is good evidence that the more efficient method gives the greater retention. This condition also gives a negative correlation between learning and recall scores. (3) When individuals who are alike in ability learn materials that are alike except in respect to length of list, there is good evidence that the learning and recall scores are positively correlated. Two of these conditions thus give a negative correlation, while the third mediates a positive correlation, and this analysis probably does not exhaust the complexities of this relationship. Hence any type of correlation may reasonably be expected for the conditions obtaining in our experiment.

Qualitative Differences in Recall.—The recall scores indicate that the two classes of subject do not differ materially in respect to the amount of repression and enhancement. However, it is possible that they do differ in respect to the items that were repressed or enhanced, and our data were further analyzed in reference to this possibility.

The repression and enhancement data for the 9-day interval are given in Figs. 3, 4, and 5. The items are distributed along the abscissa in order of their presentation during learning. The height of the graphs for each of the items represents the number of individuals in the group who recalled that item in the test. The continuous line gives the data for the psy-

choneurotic subjects, and the broken line for the normal subjects.

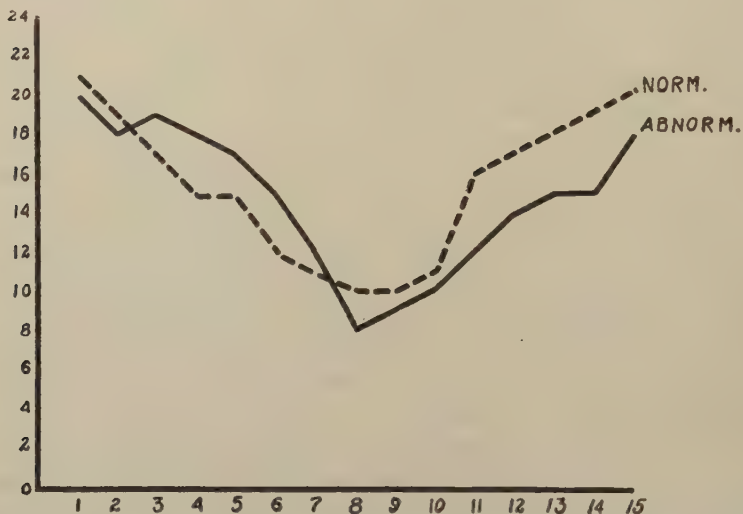


FIG. 3. Acceptable material. Individual successes in the second recall test of items by the two types of subjects.

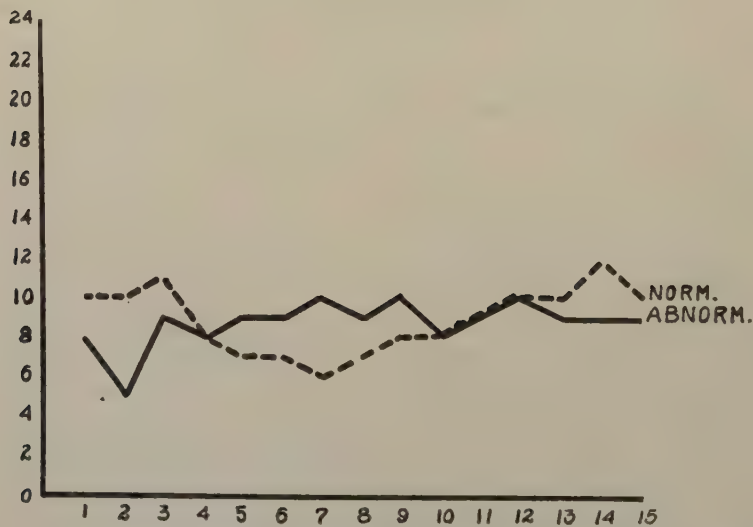


FIG. 4. Unacceptable material. Individual successes in the second recall test of items by the two types of subjects.

The curves give no decisive evidence that the two classes of subject differ in any significant fashion. We may thus

conclude that the two classes of subject do not differ significantly in respect to the character of the items that are repressed or enhanced.

We may note that these graphical data reveal one striking fact of some general significance although it has no bearing upon our experimental problem. For the acceptable and neutral materials, the relative likelihood of recalling any item is a function of its position in the list. The first and last items are most readily recalled, while those occupying the middle positions in the lists exhibit the least likelihood of

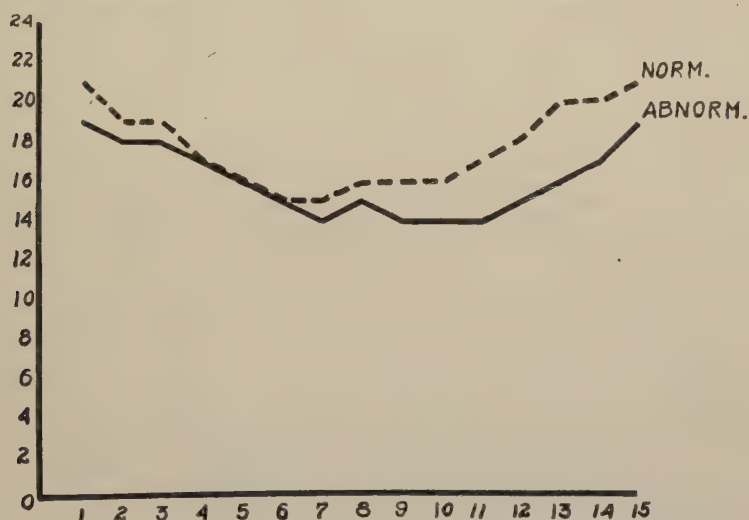


FIG. 5. Neutral material. Individual successes in the second recall test of items by the two types of subjects.

recall. The acceptable material exhibits this phenomenon to a greater degree than does the neutral list. The curves for the unacceptable material, however, give no decisive evidence that the relative likelihood of recalling any item varies with its position in the list.

Previous experiments on the so-called Laws of Primacy and Recency have shown that the rate of memorizing items is also a function of their position in the list. Consequently there is the possibility that likelihood of recall and rate of learning are correlated phenomena. To test this hypothesis, we computed the average number of trials required to memo-

size each item. These data are graphically represented in Figs. 6, 7, and 8. The items are distributed along the abscissa in the order of their presentation. The ordinal values

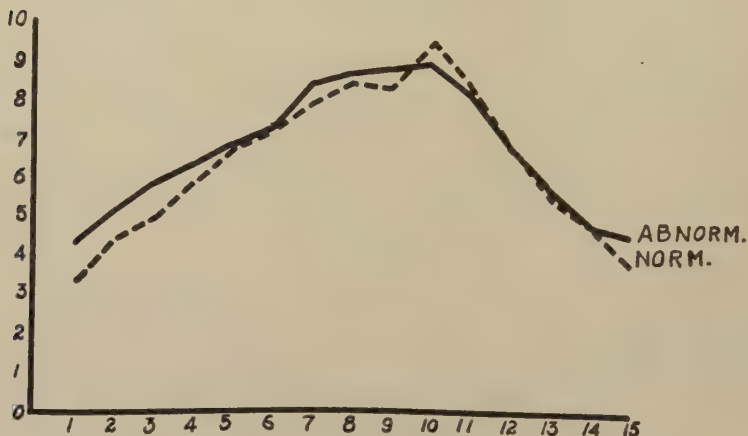


FIG. 6. Acceptable material. Average trials to learn each item by two types of subjects.

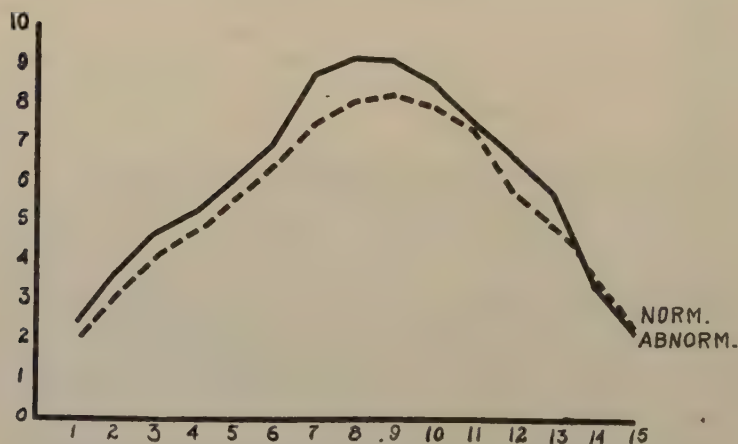


FIG. 7. Unacceptable material. Average trials to learn each item by two types of subjects.

denote the average number of trials required to learn each item. The continuous line gives the data for the psychoneurotic group, and the broken line for the normal subjects.

All six graphs exhibit the Primacy and Recency phenomena. The curves for the neutral material are relatively quite flat, but this fact is merely a function of the small number of trials required to memorize this list. Obviously the more difficult the list, the greater must be the maximal height of these curves.

A comparison of the two sets of graphs reveals the fact that relative likelihood of recall is correlated with relative rate of learning for the acceptable and neutral lists. No such relation obtains for the unacceptable material.

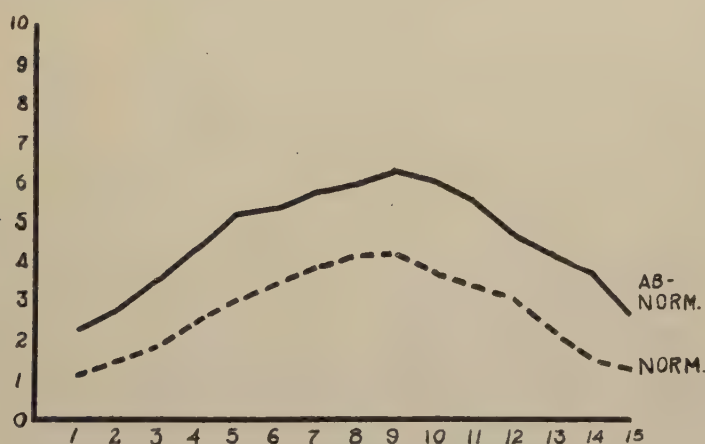


FIG. 8. Neutral material. Average trials to learn each item by two types of subjects.

There are two possible interpretations of this correlation. (1) We may assume that ease of recall is a function of ease of mastery. (2) All items continue to be presented and recalled after they are learned. Consequently we may assume that the items that are first learned exhibit the greatest degree of overlearning, and that ease of recall is a function of the degree of mastery. No reason can be assigned for the absence of this correlation for the unacceptable material.

Relearning Scores.—The relearning scores as given in Table II were transformed into saving scores by the usual formula. These saving scores purport to measure the amount retained in terms of the percentage of trials saved in relearning, while

the recall scores measure the amount retained in terms of the percentage of the total number of items that are recalled. We thus have the percentages of retention for the 16-day interval as measured by two different methods, and the comparative data are given in Table V.

TABLE V
SHOWING THE PERCENTAGE OF MATERIAL RETAINED AS MEASURED BY
THE SAVING METHOD AND THE METHOD OF RECALL

Subjects	Material	% Recalled on 3rd Recall	% Retained— Saving Scores
Normal.....	Acceptable	67.8%	69%
Normal.....	Neutral	60.8%	— .003%
Normal.....	Unacceptable	38. %	21%
Abnormal.....	Acceptable	61. %	64%
Abnormal.....	Neutral	51.1%	32%
Abnormal.....	Unacceptable	39. %	25%

While the two methods purport to measure the same thing in comparable terms, yet it has long been known that they do not give identical values. For example, Luh found that the relearning method gave the smaller values for the short intervals, while the saving scores were considerably larger than the recall scores for the one- and two-day intervals.⁸ The differences in the *size* of the two kinds of scores are thus not significant for our purposes.

It may be noted that the two methods do not give the same *order of retention* for the three materials for the abnormal subjects. From the standpoint of *relative* values, the relearning method has one serious defect. Due to its derivation, a saving score is a function not only of the amount retained but also of the rate of learning. Hence any difference in the saving scores for two lists will be determined in part by the difference in the learning scores for those two lists. The learning scores for the neutral material are much smaller than those for the other lists, and this fact has distorted the relative amounts retained as measured by the saving scores. The saving scores are an accurate measure of the relative retention of two lists

⁸ Luh. The conditions of retention. *Psychol. Mono.*, 1922, 31.

only when their learning scores are approximately equal. The learning scores for the acceptable and unacceptable lists are approximately the same, and the two methods do give the same order of retention for these materials. The two methods thus give the same order of retention for those materials that are approximately equal in respect to ease of mastery. The acceptable materials are enhanced and the unacceptable materials are repressed relative to each other when retention is measured by either the saving method or the method of recall, and this statement is true for both classes of subject.

CONCLUSIONS

This experiment was designed to test Freud's doctrine of repression and enhancement (1) for materials that conform to Freud's usage of the terms pleasantness and unpleasantness, (2) for normal and abnormal subjects, and (3) for three intervals of time after learning.

The unpleasant or unacceptable materials exhibited a considerable amount of repression relative to the neutral materials. The repression was present two days after learning, and its amount did not materially change during the subsequent two weeks. The process of repression was thus limited to the first two days after learning.

The pleasant or acceptable materials also exhibited a small amount of initial repression, and a small amount of enhancement for the last two intervals. This change from repression to enhancement was due to an actual increase in the number of items recalled on the last two tests. This enhancement occurred during the two- to nine-day interval, as there was no evidence that the amount materially changed after this time.

The two types of subject exhibited no significant differences in respect to the phenomena of repression and enhancement. Both types of subject exhibited approximately the same amount of initial repression of the unpleasant items. Both exhibited practically the same amount of initial repression of the pleasant items, and both exhibited the same amount of the subsequent enhancement of these materials. The time during which these processes of repression and

enhancement occurred was the same for the two groups. Repression and enhancement are thus universal phenomena in that they are not limited to a certain type of subject. The essential similarity of the results for the two classes of subject may be cited in support of their reliability.

So far as these materials are concerned, the experimental results establish the truth of Freud's assumption of the existence of the phenomena of repression and enhancement. They also confirm his assumption of the universal character of these phenomena.

The data also reveal several unsuspected facts. (1) The process of repression affects both the pleasant and unpleasant materials but to an unequal degree. (2) In both cases, the process of repression is limited to the first two days after learning. This fact suggests that repression is an automatic process in that it takes place prior to the first recall. (3) Enhancement, on the other hand, is limited to the pleasant materials, and it does not occur until after the first recall. This fact suggests the possibility that the enhancement of the pleasant materials may be a function of the prior recall.

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